

# GNEP: Global Nuclear Energy Partnership

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## Why Recycle?



### Benefits of Recycling

- Separate Cs and Sr that create short-term heat loads and allow to decay for about 100 years outside of repository
- Separate and destroy TRUs that create long-term heat loads (1000s of years) through transmutation
- Only other FP's and trace amounts of TRUs should be sent to a geologic repository

Elimination of 99% of Cs, Sr and 99% of TRUs would result in approximately 90 times capacity increase for Yucca Mountain

### Number of Repositories Needed at 70,000 Metric Tons Each

Nuclear Futures		Existing License Completion	Extended License Completion	Continuing Level Energy Generation	Continuing Market Share Generation	Growing Market Share Generation
Cumulative discharged fuel in the year 2100 (metric ton)		100,000	120,000	250,000	600,000	1,400,000
No Recycle	Once-Through	2	2	4	9	20
	Once-Through, High Burnup Fuels	2	2	3	7	17
Reprocessing and Recycle	Limited Recycle, High Burnup Fuels	Recycle Not Recommended		2	5	10
	Transitional and Sustainable Recycle			1	1	1

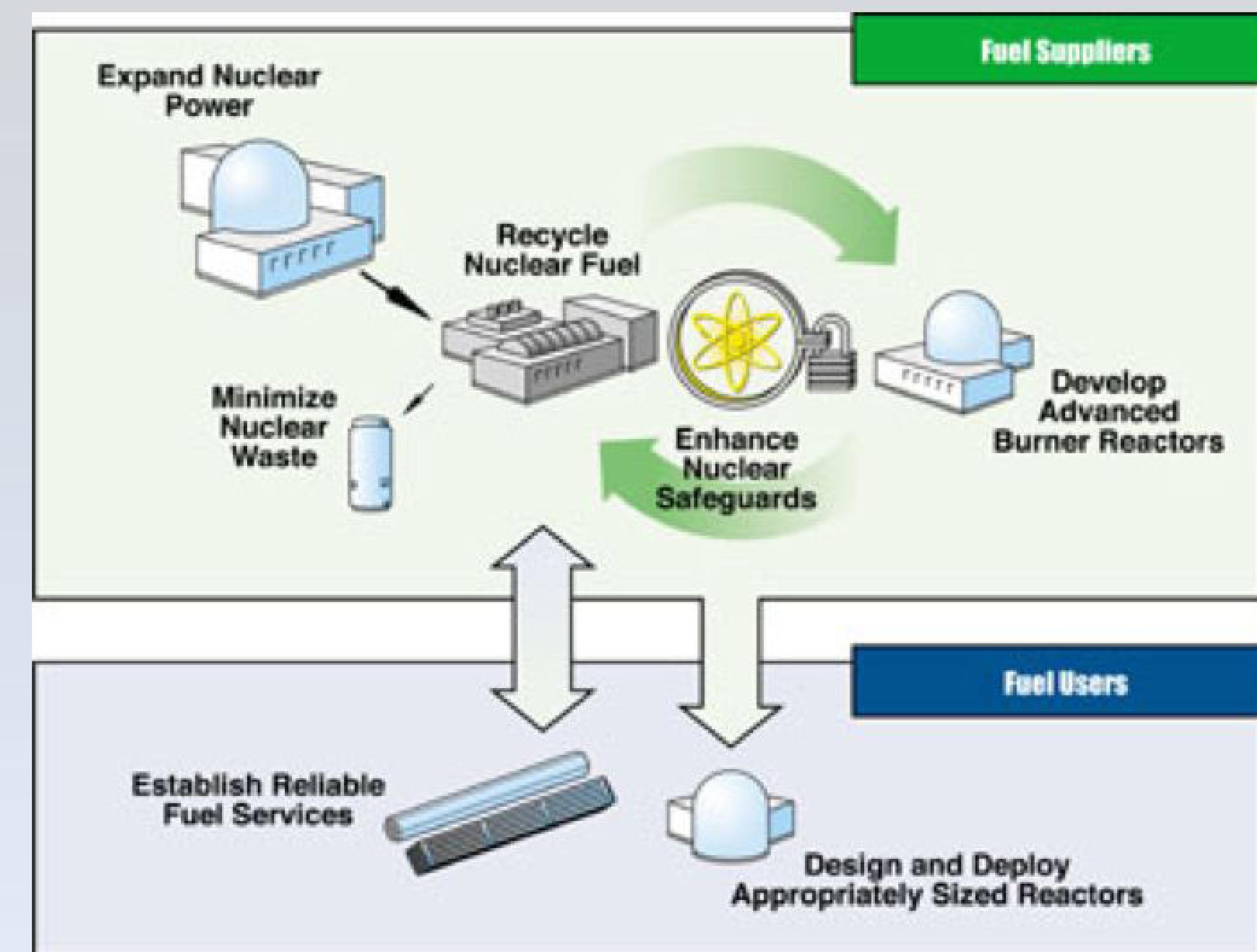
Extended License Completion – Nuclear plants are retired after 60 years  
Continuing Level Energy Generation – Replacement plants are built as current plants retire  
Continuing Market Share Generation – Replacement plants and additional plants are built to maintain nuclear energy's 20% electricity market share (1.8% growth)  
Growing Market Share Generation – Nuclear market share grows, both for electricity and for hydrogen production (3.2% growth)

If recycling is not implemented, the U.S. will need 9 Yucca Mountain sized repositories by 2100 at continuing market share generation. Also, note above that most of the heat and dose in spent fuel comes from Transuranics. Recycling would help to destroy these elements and promote a spent fuel much more adapt for final storage.

## Closing the Fuel Cycle/GNEP

### Purpose

As part of President Bush's Advanced Energy Initiative, the Global Nuclear Energy Partnership (GNEP) seeks to develop worldwide consensus on enabling expanded use of economical, carbon-free nuclear energy to meet growing electricity demand



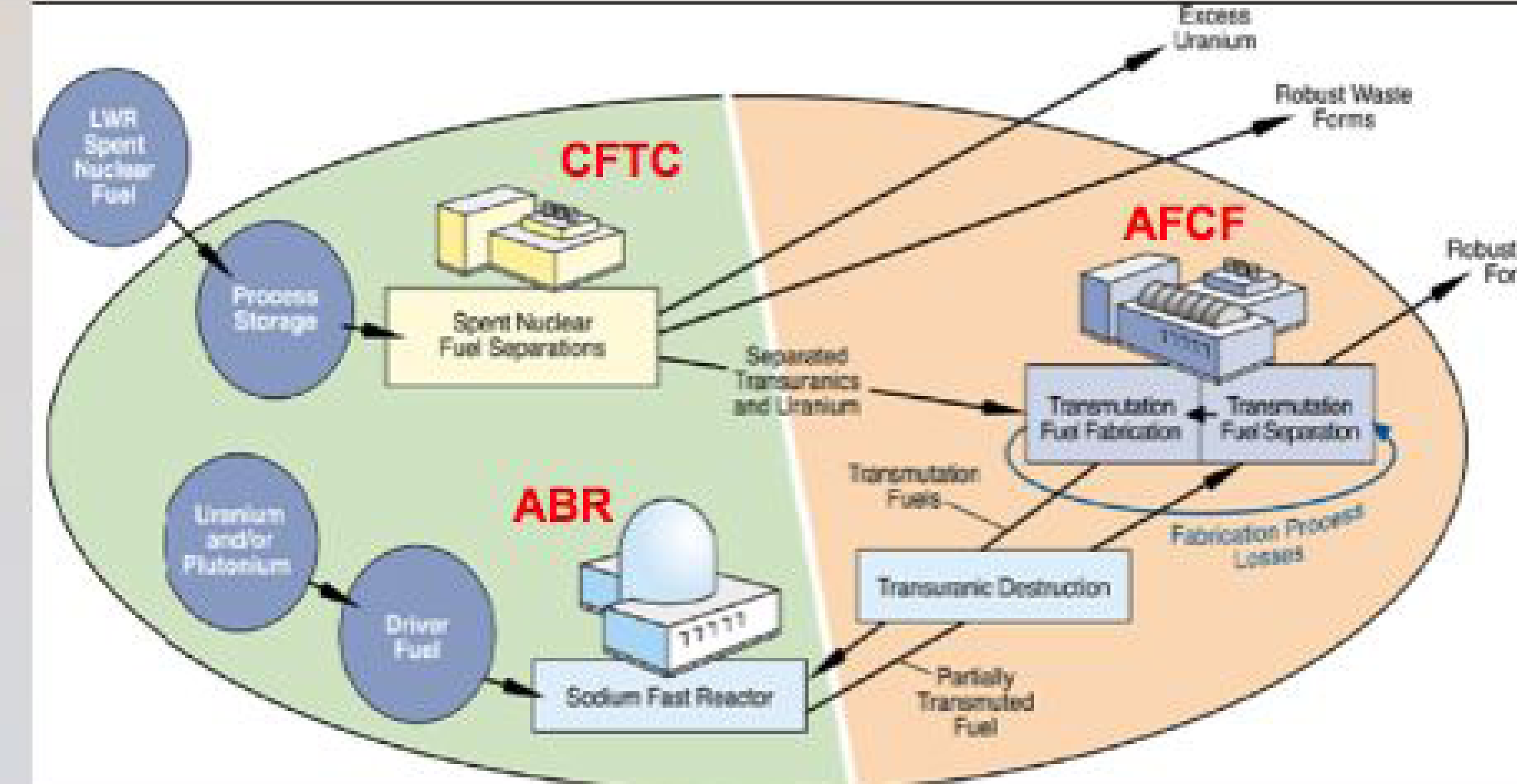
### Benefits

- Provide abundant energy without generating carbon emissions or greenhouse gases.
- Recycle used nuclear fuel to minimize waste and reduce proliferation concerns.
- Safely and securely allow developing nations to deploy nuclear power to meet energy needs.
- Assure maximum energy recovery from still valuable used nuclear fuel. Reduce the number of required U.S. geologic waste repositories to one for the remainder of this century.

**Global Nuclear Energy Partnership**  
Accelerating Clean and Safe Nuclear Energy

## GNEP

A major element of GNEP is the development and eventual commercial deployment of advanced nuclear fuel recycling technologies. DOE has proposed three interrelated project-specific GNEP facility-types to close the fuel cycle: a nuclear fuel recycling center or Consolidated Fuel Treatment Center (CFTC); an advanced recycling reactor or Advanced Burner Reactor (ABR); and an advanced fuel cycle research facility also referred to as the Advanced Fuel Cycle Facility (AFCF).



## CFTC (Consolidated Fuel Treatment Center)

- Intends to be a reprocessing and fuel fabrication facility
- It is anticipated that DOE, partnered with industry, will use an aqueous (e.g. UREX+) separation technology, to separate spent LWR fuel into its uranium, transuranic (TRU), and fission product components
- The recovered uranium and TRU radionuclides will be used in fabricating fast reactor driver fuel and TRU transmutation fuel



An example of a large reprocessing facility is La Hague, located on the western tip of the Cotentin Peninsula in Normandy, on the English Channel. The facility is owned and operated by UREX+, a joint venture between Urenco and British Nuclear Fuels. The facility recycles spent nuclear fuel to produce uranium and plutonium for use in nuclear reactors. It also produces high-level waste for disposal in a geological repository.

## ABR (Advanced Burner Reactor)

- An advanced recycling reactor to burn the actinide based fuel to transform the actinides in a way that makes them easier to store as waste and produces electricity.
- DOE has focused on liquid-metal- (e.g., sodium) cooled fast reactors, because it believes the technology to be the most mature.



The Fast Flux Test Facility (FFTF) is a 400 megawatt (thermal) fast-neutron reactor owned by the U.S. Department of Energy (DOE). The facility is located in the 400 West of Hanford Site in southeastern Washington State. Currently, the FFTF is undergoing decommissioning.

## AFCF (Advanced Fuel Cycle Facility)

- A modern state-of-the-art laboratory designed and operated by U.S. national laboratories to serve reactor fuels research needs for the next 50 years.
- It would use modular, flexible construction techniques with near-term priority given to the fabrication and qualification of fuels for an advanced fast reactor
- Will test separations processes on fast reactor spent nuclear fuel and fabricate initial fast reactor transmutation fuel for irradiation in an ABR.

## Impact GNEP would have on NRC

- Environmental Reviews
  - EIS required for all new facilities
- Security and Safeguards
  - Changes may be needed to Part 73 (Physical Protection), Part 74 (MC&A), and Part 75 (International Safeguards)
- Internal Coordination
  - NMSS, RES, NRR, OGC, NRO, OIP
  - Ensure proper skill sets are recruited
  - Knowledge Management of existing skill sets
- External Coordination/Partnerships
  - DOE
    - Close interactions needed during the demonstration phase and maintain significant contact if program goes to full scale
  - National Labs
  - International
    - Gain knowledge from international experience
  - Federal agencies - OSHA, EPA, DOT, DHS

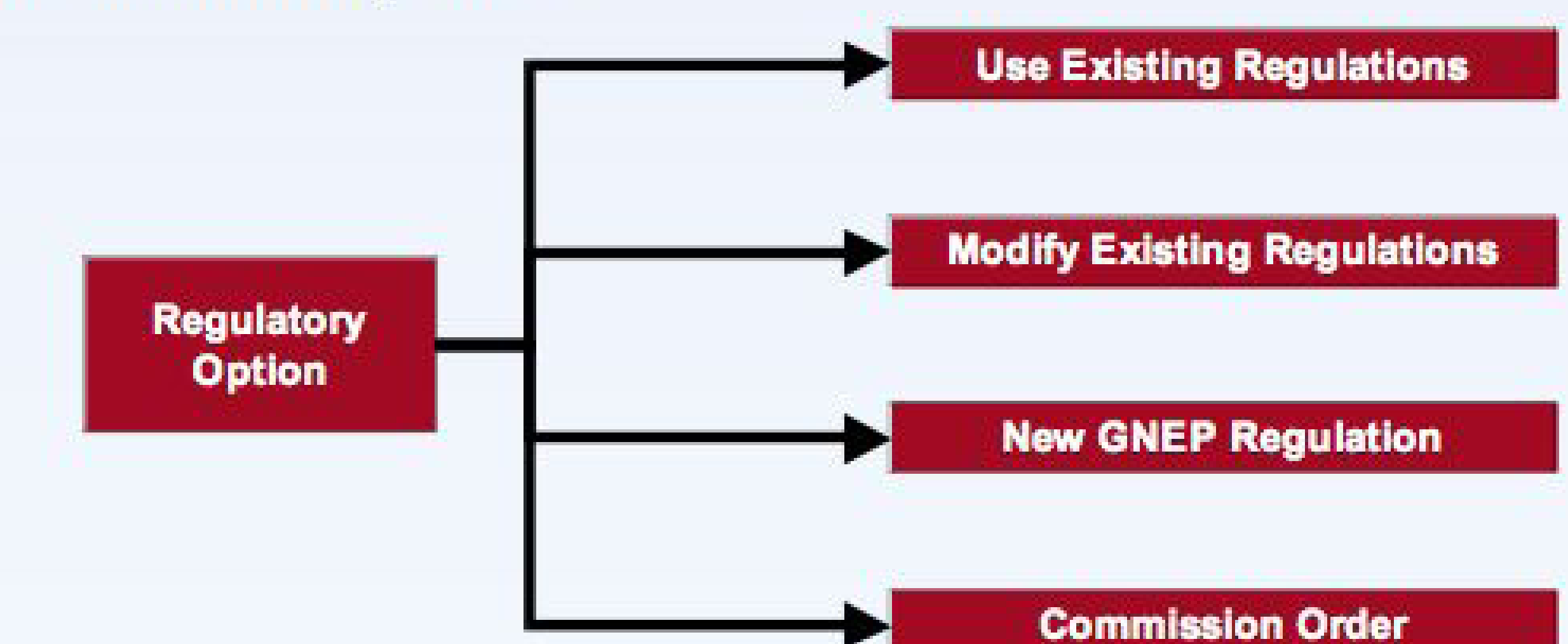


## Regulations Pertinent to GNEP

Site Boundary		Likely NEPA Boundary	
SNF Storage Part 72	REPU Storage Part 70	ABR 1 New Reg or Part 50/52	ABR 2 New Reg or Part 50/52
Reprocessing and Separations New Reg or Revised Part 70		ABR/Actinide Fuel Fabrication And SNM, TRU, and New Fuel Storage New Reg Or Revised Part 70	
HLW Vitrification And Storage Part 70	Cs/Sr/non-TRU Waste Solidification And Storage Part 30 or 70	TRU Stabilization, Waste Solidification, And Storage Part 70	

## Options for Regulating Commercial GNEP Facilities

Options to develop a regulatory licensing framework for commercial GNEP facilities and associated spent nuclear fuel. Any commercial operations would need to be licensed by NRC.



\*The AFCF is not intended for commercial use, and will likely be located at an existing DOE laboratory. NRC does not have regulatory authority over this type of DOE facility unless otherwise directed by Congress.